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**Note on Mature Female of *Itoitantulus misophricola* Huys,
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With Text-figures 1-2

Abstract A mature adult female of *Itoitantulus misophricola* Huys, Ohtsuka & Boxshall, 1992 (Crustacea: Tantulocarida: Deoterthridae) is described for the first time from the host misophrioid copepod *Misophriopsis okinawensis* Ohtsuka, Huys, Boxshall & Itô, 1992 collected off Okinawa, South Japan. The female contains 26 mature, spherical eggs of ca. 30 μm in diameter in the trunk sac, and is characterized by the lack of an elongate neck region formed between the larval cephalon and the expanded trunk sac. Mature females of the families Basipodellidae, Deoterthridae and Doryphallophoridae possess a characteristic of the lack of an elongate neck region, whereas those of the families Microdajidae and Onceroxenidae, in particular, *Microdajus* spp., have a well-developed neck region.

Key words: *Itoitantulus misophricola*, Tantulocarida, Deoterthridae

Introduction

The small-sized ectoparasitic crustacean group Tantulocarida exclusively utilizes free-living crustaceans such as copepods (e.g., Becker, 1975), ostracods (Bradford & Hewitt, 1980), isopods (e.g., Boxshall & Lincoln, 1983), cumaceans (Bonnier, 1903), and tanaidaceans (e.g., Greve, 1965) as host. Over 20 species have been reported from subtidal to abyssal zones in the Atlantic and Indo-Pacific regions (see Huys, 1991). The hypothetical life cycle of Tantulocarida was clearly presented by Boxshall & Lincoln (1987) and Huys (1991). The Tantulocarida has a single larval stage, which is often found free-living in sediments before attaching to a crustacean host (Huys, 1989, 1991; Huys, Andersen & Kristensen, 1992). The female sloughs the larval pedigerous and abdominal somites and develops a sac-like trunk with eggs behind the larval cephalic shield. Females of the following 10 species have been described: *Basipodella harpacticola* Becker, 1975 and *B. atlantica* Boxshall & Lincoln, 1983 (Basipodellidae); *Coralliotantulus coomansi* Huys, 1990 and *Itoitantulus misophricola* Huys, Ohtsuka & Boxshall, 1992 (in Huys, Ohtsuka, Boxshall & Itô, 1992) (Deoterthridae); *Microdajus langi* Greve, 1965 and *M. gaelicus* Boxshall & Lincoln, 1987 (Microdajidae); *Onceroxenus birdi* Boxshall & Lincoln, 1987 and *O. curtus* Boxshall & Lincoln, 1987 (Onceroxenidae); *Doryphallophora harrisoni* (Boxshall & Lincoln, 1987) (Doryphallophoridae); *Cumoniscus kruppi* Bonnier, 1903 (incertae sedis).

From Japan, Huys, Ohtsuka, Boxshall & Itô (1992) first reported the tantulo-

caridan *Itoitantulus misophricola* parasitic on the hyperbenthic misophrioid copepod *Misophriopsis okinawensis* Ohtsuka, Huys, Boxshall & Itô, 1992. However, they described only the tantulus larva and immature male and female of *I. misophricola*. One of the host misophrioid copepods which were not examined in my previous work (Ohtsuka et al., 1992) was parasitized by a mature female of *I. misophricola*. The present paper describes the mature female of *I. misophricola* and compares it with other tantulocaridan females.

Materials and Methods

The host misophrioid copepod *Misophriopsis okinawensis* was collected from hyperbenthic water off Kume Island, Okinawa, South Japan (26° 17.9' N, 126° 54.2' E) on 23 May 1989 (local time 0824–0858) with an originally designed sledge-net (Ohtsuka et al., 1992; Huys, Ohtsuka, Boxshall & Itô, 1992). Sampling gear and techniques and laboratory procedures have been described in detail elsewhere (Ohtsuka et al., 1992).

Description

Mature female of *Itoitantulus misophricola* (Figs. 1 & 2)

The specimen was attached to the first endopod segment of the left maxilliped of a copepodid V of *Misophriopsis okinawensis*. The cephalic shield (Fig. 1, C) and the cephalic stylet (Fig. 1, CS) are as described for the tantulus larva (cf. Huys, Ohtsuka, Boxshall & Itô, 1992, p. 880, Fig. 4B-G). The cephalic shield is 66 µm long. The scar (Fig. 1, S) is anteroventrally located. The adult female lacks a long neck region formed between the larval cephalosome and the trunk sac. The trunk is posteriorly expanded to form an oval brood sac which is 274 µm long. The trunk surface is smooth and devoid of wrinkles such as are found in the immature female of *Coralliotantulus coomansi* by Huys (1990b) and *Onceroxenus curtus* by Boxshall & Lincoln

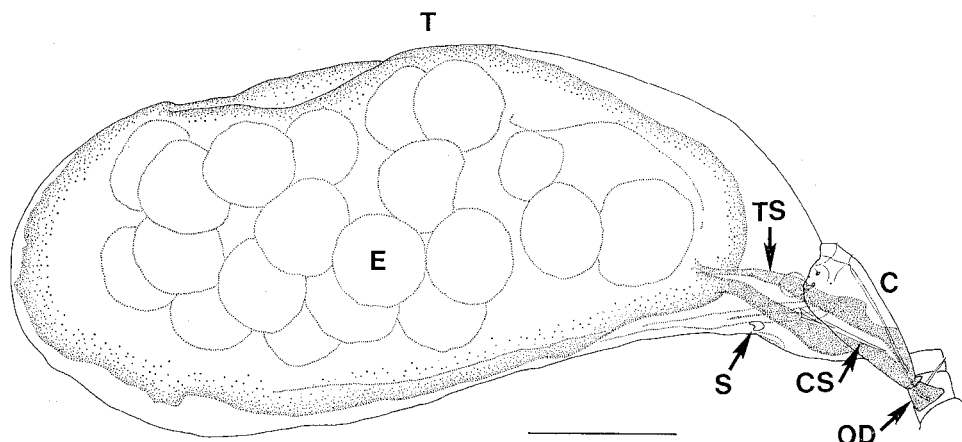


Fig. 1. *Itoitantulus misophricola* Huys, Ohtsuka & Boxshall, 1992. Mature female. Habitus, lateral view. C: cephalic shield; T: trunk; S: scar; OD: oral disc; TS: tubular structure; CS: cephalic stylet; E: egg. Scale bar=50 µm.

(1987) (Fig. 2A). The translucent anterior part of the trunk is empty (Fig. 2B). The brood sac is connected with the oral disc by a tubular internal structure (Fig. 1, TS) and contains 26 spherical, mature eggs of about $30\text{ }\mu\text{m}$ in diameter (Fig. 1, E). The eggs are medially located within an inner cellular sac. Eggs at the multi-celled stage are clearly visible in the sac.

No gonopore like that observed in a fully grown female *Microdajus langi* with SEM (Huys, 1991) was discernible with LM, but approximately $20\text{ }\mu\text{m}$ long, postero-ventral slit-like structure is present.

Discussion

The structures of the neck regions of 9 species belonging to the five recognized families of the Tantulocarida show great variability. *Microdajus langi*, *M. gaelicus*, *Onceroxenus birdi*, and *O. curtus* have a long, folded and twisted neck region. On the other hand, *Basipodella harpacticola*, *B. atlantica*, *Coralliotantulus coomansi* and *Itoitantulus misophricola* are devoid of such a neck. Mature females of the four species with the neck, in particular *Microdajus* spp., are relatively large-sized, ca. $500\text{--}900\text{ }\mu\text{m}$ in total

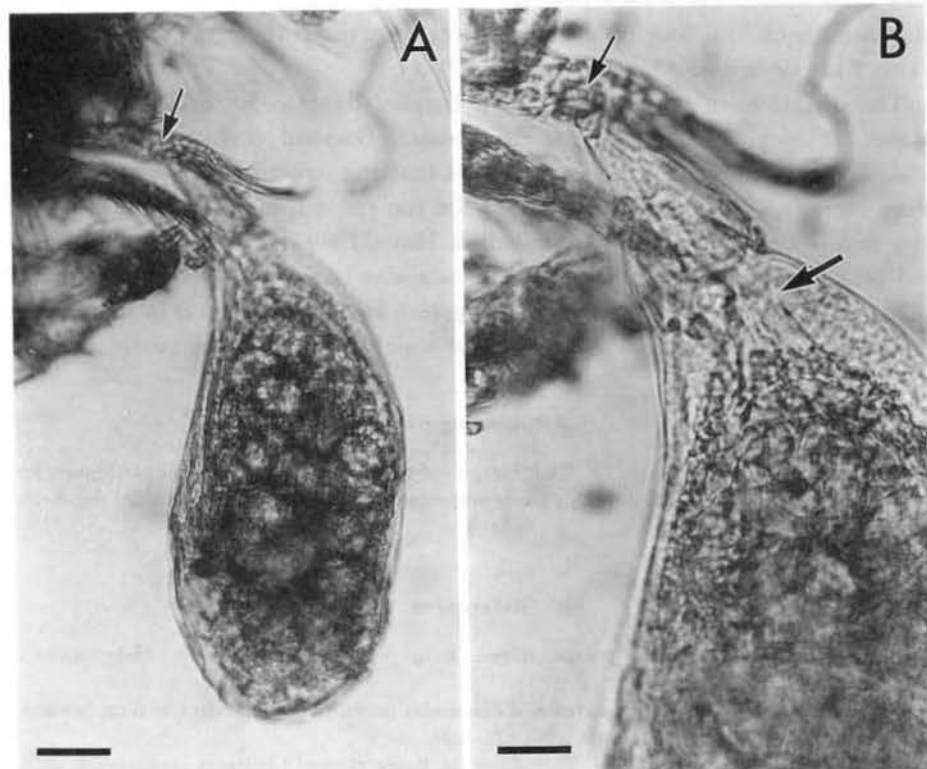


Fig. 2. *Itoitantulus misophricola* Huys, Ohtsuka & Boxshall, 1992. Mature female. A. Habitus, lateral view, attachment site indicated by an arrow, scale bar = $40\text{ }\mu\text{m}$; B. Cephalic shield and anterior portion of trunk, attachment site indicated by a small arrow and tubular structure by a large arrow, scale bar = $20\text{ }\mu\text{m}$.

length, and parasitize deep-sea tanaidaceans. Mature females of the species without a neck are small, measuring about 100–300 μm in total length, and infest small copepods. Since only immature females of *Doryphallophora harrisoni* were reported (cf. Boxshall & Lincoln, 1987), there remains a possibility that mature females of this species have a neck, because *D. harrisoni* parasitizes relatively large-sized, asellote isopods.

In *M. langi* with a long neck region, the brood sac is very large, containing up to 100 eggs of 33 μm in diameter (Greve, 1965; Grygier & Sieg, 1988). *M. gaelicus* also has more than 100 eggs in the trunk sac (Boxshall & Lincoln, 1987). Eggs of *I. misophricola* are of nearly the same size as those of *M. langi*, though the number of eggs is 26 in *I. misophricola* and much fewer than in *Microdajus* spp. Large-sized, fully developed, adult females of *Microdajus* spp. seem to interfere with the behaviors of their hosts (cf. Boxshall & Lincoln, 1987). However, tantulocaridans must obtain their nourishment from "living" host crustaceans while they attach to the hosts. Therefore, tantulocaridans parasitic on small-sized copepods may not have a developed, elongate neck region and may produce fewer eggs within the relatively small trunk sac than tantulocaridans parasitic on tanaidaceans and isopods, which can be interpreted as an adaptation to their parasitic life on tiny hosts. It is likely that the folded and twisted neck functions as shock absorber to prevent the large brood sac of the parasite from detaching from the host.

The diagnoses of the tantulocaridan families have so far been given only for tantulus larvae and males but not for females (Boxshall & Lincoln, 1987, Huys, 1990a, 1991). The present finding suggests that the structure of the neck region of mature females is one of key characters for the respective family. The most primitive family Basipodellidae (cf. Boxshall & Huys, 1989, Huys, 1990a) has no developed neck while the advanced family Microdajidae has an extremely elongated neck region. Considering these points, the elongation of a neck region is in more advanced state, and might have evolved in groups which infest deep-sea tanaidaceans.

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Note in proof. Huys, Boxshall & Lincoln (in press. The tantulocaridan life cycle: the circle closed? *J. Crust. Biol.*, 13(3)) first found two life cycles in the Tantulocarida, namely, parthenogenetic and sexual pathways. Since the sexual female is a free-living stage (Huys et al., in press), the female of *Itoitantulus misophricola* described here is parthenogenetic.